x. Trim Quadrupole

There are no sextupole magnets in the 8 cm aperture CQS assemblies 4 through 8 in the insertion region. The space normally occupied by sextupoles in CQS assemblies 4, 5 and 6 is used for individually powered trim quadrupoles. The construction of the trim quadrupole cold mass is substantially the same as that of the sextupole cold mass. The wire to be used is identical; its parameters are given in Table 1-6. The number of turns is the same and the winding profile of the coils is similar. There are four coils required for each trim quadrupole cold mass. These fit around the four poles of the trim quadrupole yoke. At a radius beyond that of the coil/yoke poles, the yoke cross section is identical to that of the sextupole cold mass. The low carbon steel laminations making up the yoke must be accurately stamped, because the field shape in these magnets is dominated by the iron, relieving the construction tolerances for the coils. The coil and yoke lengths are the same for the trim quadrupole cold mass as for the sextupole cold mass. The coils are held in place in the slots in the steel stampings by thin, beryllium-copper springs between the coil and the pole on each side, expanding the coil in the direction of the Lorentz force against the slot wall.

Figure 1-16 shows a cross section of the trim quadrupole cold mass. The parameters of the trim quadrupole cold mass are given in Table 1-26.

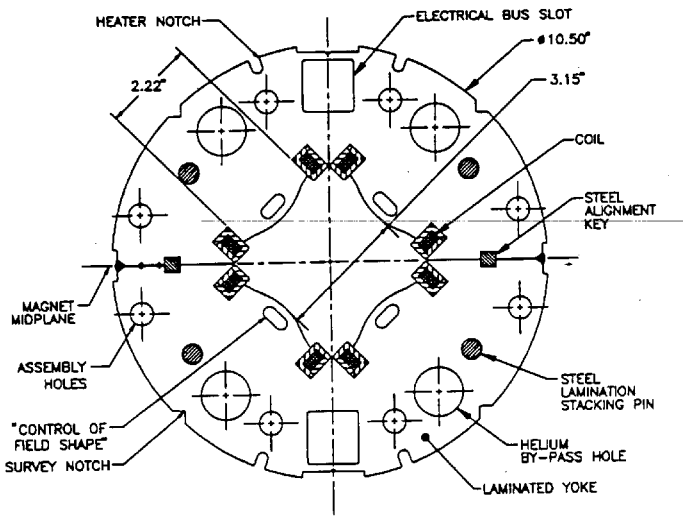

Fig. 1-16. Cross section of the trim quadrupole cold mass. All lamination dimensions outside the pole area are identical to those in the sextupole lamination.

Table 1-26. Design Parameters for the 80 mm Aperture RHIC Trim Quadrupole

GENERAL		
Total number required	72	
Gradient @ 100 A	28.3	T/m
Transfer function @ 100 A	28.3	$G \cdot cm^{-1}/A$
Nominal operating current	100	A
Quench current	182	A
Inductance @ 100 A	590	mH
Effective length	0.75	m
COIL		
Number of turns	200	
Coil length, overall	(31.9 in.) 0.81	m
Final molded coil width	(3.03 in.) 77.0	mm
Length of wire per coil, estimated	(14400 in.) 366	m
Wire diameter, bare	(0.020 in.) 0.5	mm
YOKE		
Pole width	(2.22 in.) 56.39	mm
Length of stacked laminations	(31.9 in.) 0.81	m
Weight of steel	(550 lb) 249	kg
Outer diameter	(10.5 in.) 266.70	mm
Lamination thickness (16 gauge)	(0.060 in.) 1.5	mm
(18 gauge)	(0.048 in.) 1.2	mm
Number of helium by-pass holes	4	
Diameter of helium by-pass holes	(1.187 in.) 30.15	mm
Bus cavity width & height	(1.25 in.) 31.75	mm